

Lithuania's Export Diversification According to Technological Classification¹

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Abstract

The ability of export to withstand different shocks of demand and supply is extremely important for sustainable export growth. One of the ways to reduce the impact of these shocks is diversification of the exported production by products and geographical markets. In this article, the authors analyse Lithuanian manufacturing industries with different technological levels and distribution of the export by geographical markets and products. Also, export concentration indexes have been calculated and compared by the qualities mentioned above. For the analysis we use the data from the bases of Lithuanian Department of Statistics (Statistics Lithuania) for the year 2011. The analysis showed that the export of traditional technology industry, which is extremely important to Lithuanian economics, is best-prepared from all sectors to withstand unfavourable external effects. Also, considering the fact that traditional technology industries are not homogenous and their subsectors create the products of different value added (also very high), it can be stated that this sector can be competitive in long term.

Keywords: technological level, manufactures, export diversification, concentration index, Lithuania.

1. Introduction

In the post-crisis period, Lithuanian export has become the main factor of economic growth and it has managed to avoid negative effects. Anyway, evaluating future prospects, declining dynamics of Russian economics and the recession in Euro zone, it can be stated that negative impact of these factors on Lithuanian export is presumable. Openness of economics determines the fact that economics can be injured by external economic upheaval, but the volume of the effects much depends on the degree of export portfolio concentration. As the majority of the research shows (Pineres, Ferrantino, 1997; Al-Marhubi, 2000, ESCAP, 2004; Songwe, Winkler, 2012, Cottet, Madariaga, Jegou, 2012), higher degrees of export concentration are strongly correlated with greater volatility in export earnings and economic growth rates. Contribution of industry sectors with different technological level to the growth of the economics of the country is diverse. Strategic orientation of Lithuanian economic development towards the sectors of medium – high value added has partly determined significantly lower state attention to the promotion of traditional technology industries. For instance, considering the innovation promotion system, it is important to note that the companies of tradition technology industry use relatively smaller amount of the support due to their lower absorption abilities. Nevertheless, the government ensures adequate measures to help industrial companies increase their innovative abilities and so absorb the biggest amount of the support designed for the creation of innovations (Ernst & Young, 2012). The sectors of high value added and high technologies still make only 2 per cent of all export value in total Lithuanian export structure while the biggest part is taken by lower technologies, or so-called traditional technology industries. That is why export changes in this industrial sector have a significant impact on total economics of the country. Significant contribution of Lithuanian traditional technology industry to the development of all manufacturing industry and total economics has been confirmed by numerous scientific researches (Pridotkiene, Laskiene, Venckuviene, 2013; Saboniene, Masteikiene, Venckuviene, 2013). Considering significant impact of exports on total economics of the country, we aim to compare export

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diversification levels of particular industry sectors that have been divided into different technological levels and answer the question which Lithuanian manufacturing industry sector is most protected from possible external upheavals and ensures higher stability to the economics of the country. This way, the aim of our research is to analyse export diversifications of particular Lithuanian manufacturing industry sectors by products and markets and calculate export concentration degrees which would enable to identify export market diversification levels in particular industries.

2. Methodology and Data

Scientific literature proposes various ways to measure export diversification. The choice of a measure usually corresponds to different definitions, dimensions, forms and levels of diversification. The measures of diversification are as follows: The Commodity – Specific Cumulative Export Experience Function (CSCEEF), the Absolute Deviation of the Country Commodity Shares, the Commodity Specific Traditionalist Index (CSTI) and the Variance of the CSTI. The most commonly used measures of export diversification are the Concentration Ratios (measuring product or geographic concentration) (Samen, 2010). Several measures have been developed to estimate concentration ratios. The Herfindahl - Hirschman index (HHI) is the most widely used measure of the degree of market concentration. HHI shows how a product market is concentrated in a few countries or homogeneously distributed among several countries. Likewise, it shows how exports of particular countries or country groups are concentrated on several products or otherwise distributed in a more homogeneous manner among a series of products.

Herfindahl – Hirschman index as the measure of the degree of market concentration by countries and geographical regions may be expressed as follows (United Nations Conference on Trade and Development, 2012):

$$HHI_j = \frac{\sqrt{\sum_{i=1}^n \left(\frac{x_{ij}}{X_j}\right)^2 - \frac{1}{n}}}{1 - \sqrt{\frac{1}{n}}} \quad (1)$$

where: HHI_j – concentration index of a country or country group, x_{ij} – value of export for country j and product i , $X_j = \sum_{i=1}^n x_{ij}$ – total export, n – number of products.

Herfindahl – Hirschman index as the measure of the degree of market concentration by products may be written as follows (United Nations Conference on Trade and Development, 2012):

$$HHI_i = \frac{\sqrt{\sum_{j=1}^n \left(\frac{x_{ij}}{X_i}\right)^2 - \frac{1}{n}}}{1 - \sqrt{\frac{1}{n}}} \quad (2)$$

where: HHI_i – value of concentration index for product i , x_{ij} – value of export for country j and product i , $X_i = \sum_{j=1}^n x_{ij}$ – total export, n – maximum number of individual economies.

HHI value can vary between 0 and 1. When total export consists only of a single group of products or the products are exported to a single country – trade partner, the index gains its highest value. An index value that is close to 1 indicates a very concentrated market. On the contrary, the bigger is the number of exported product groups or export countries the lower is a possible value of the index. Value 0 reflects a completely equal distribution of products or countries.

Sub-ranges of Herfindahl – Hirschman index are listed below (U.S. Department of Justice and the Federal Trade Commission, 2010, Mundeikis, 2013):

- $HHI < 0.01$ indicates a highly diversified market;
- $0.01 < HHI < 0.15$ indicates an un-concentrated market,
- $0.15 \leq HHI < 0.25$ indicates a moderately concentrated market,
- $HHI \geq 0.25$ indicates a highly concentrated market.

The HHI calculations are performed using Lithuanian export-of-goods data, disaggregated to the Classification of Products by Activity (CPA 2008) at 2-digit and at 4-digit group level. The choice of CPA classification has been determined by the fact that it enables to select the volumes of the export of the products which are exclusively of Lithuanian origin. Since our aim is to evaluate diversification level of the export of the products that have been manufactured in Lithuanian industry, our analysis does not include the data of re-export. For the analysis, we use the data from the Lithuanian Department of Statistics (Statistics Lithuania) bases for the year 2011.

Exports are divided into 20 product groups, which are then allocated into 4 broad categories according to their technological intensity (i.e. low, medium-low, medium-high and high-tech) (Table 1).

Table 1. Classification of manufacturing industries by level of technology

Level of technology	Industries	CPA 2008	Level of technology	Industries	CPA 2008
High-technology industries	Air, spacecraft and related machinery	C30.3	Medium-high-technology industries	Electrical machinery and apparatus	C27
	Pharmaceuticals	C21		Motor vehicles, trailers and semi-trailers	C29
	Computer, electronic and optical products	C26		Chemicals, excluding pharmaceuticals	C20
				Machinery and equipment, n.e.c.	C28
				Other transport equipment	C30 excl. C30.3, C30.1
Low-technology industries	Wood and products of wood, except furniture	C16	Medium-low-technology industries	Ships and boats	C30.1
	Furniture	C31		Rubber and plastics products	C22
	Paper products, printing	C17, C18		Coke and refined petroleum products	C19
	Food products, beverages and tobacco products	C10, C11, C12		Other non-metallic mineral products	C23
	Textiles, wearing apparel, leather and related products	C13, C14, C15		Basic metals and fabricated metal products	C24, C25
	Other manufactured goods	C32			

Source: adapted by the authors with reference to Hatzichronoglou (1997).

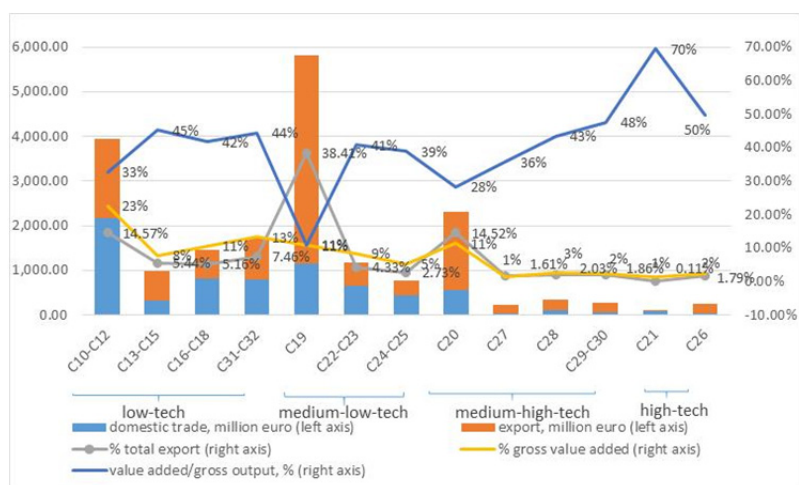
Table 1 provides the details of the classification of the industries into high, medium-high, medium-low and low-tech. This system proposed by Hatzichronoglou (1997) is used in the official OECD (The Organisation for Economic Co-operation and Development) manufacturing industry classification according to technological intensity.

3. Finding and Discussion

3.1 The analysis of Lithuania's manufacturing industry

In this analysis, we aim to establish the main sectors of Lithuania's industrial export dividing them by their technological intensity and comparing them with each other by the four following indicators: gross output, share of value added in gross output, share of value added in gross value added and share of the export in total export of manufacturing industries. Figure 1 reflects the results of the analysis. In this figure, gross output has been shown as the total amount of domestic trade and export.

Figure 1. Lithuanian manufacturing industry's export, gross output and value added in its particular sectors in 2011



Source: Authors' analysis.

Considering particular industries, highest gross output has been created by coke and refined petroleum products, attributed to medium-low-technology industry. In 2011, their gross output made 5811 million euro or 30 per cent of manufacturing industry's gross output (see Figure 1). The other product group is food products, beverages and tobacco products which are attributed to low technology industry. Their gross output the same year made 3939 million euro or 20.3 per cent of manufacturing industry's gross output. Chemicals and chemical products (excluding pharmaceuticals) are attributed to medium-high technology industry, and they also take a significant part in manufacturing industry's gross output structure. In 2011, the gross output of these products reached 2307 million euro which made nearly 12 per cent of manufacturing industry's gross output. Further analysis has revealed that apart from these three biggest sectors, the biggest share of gross output has been created in low-technology or so-called traditional technology industry. Next positions have been taken by medium – low, medium- high and finally – high-technology industries. The latter makes only 2 per cent of manufacturing industry's gross output.

Economic growth and well-being of the population during the long term can be ensured only by reorientation to the sectors of high value added. Therefore, the indicator of value added is much more informative evaluating particular industry sectors. With reference to the results of the analysis, it can be seen that all three sectors that generate the highest gross outputs, create the lowest values added. This is particularly true of C19 product group - coke and refined petroleum products manufacturing. This is because all mineral fuels are imported and processed in one factory - "Orlen Lithuania" - without creating high value added. The values added created by medium traditional industries and medium technology industries are similar (range from 41 to 48 per cent). However, as it could be expected, these values are lower than the ones created in high technology industries. For instance, in the manufacture of basic pharmaceutical products and pharmaceutical preparations, value added makes 50 per cent of gross output.

Anyway, analysing the share of value added in manufacturing industry's gross value added, it can be seen that the highest value added in Lithuania is generated in low-tech-industry. In 2011, the value added generated in this sector made 55 per cent of gross value added in all manufacturing sector. Medium-low-tech industry generated 25 per cent, and medium-high-tech industry – 17 per cent of gross value added. High technology sector which is considered to be a priority sector in Lithuania creates only 3 per cent of gross value added.

Evaluating Lithuanian industry sectors by export values, it can be seen that medium-low-tech industry makes the biggest share (45.47%) of exports. 38.41 per cent of the exports in this share goes to coke and refined petroleum products. As it has already been stated, this industry generates relatively low value added while the biggest share of gross value added is made by imported intermediate products (mineral fuels), so this sub-sector can be treated as re-export. What is more, the value of these products depends on global oil prices, so it is very unstable and due to its volumes distorts the indicators of other sectors. Evaluating the volumes of export excluding petroleum products, it can be seen that the share of exported low-tech products is the biggest. The export of this sector makes 32.62 per cent of the total value of the export. With reference to the data of 2011, medium-high-tech sector made 20.01 per cent, medium-low-tech sector excluding petroleum products – 7.07 per cent, and high-tech sector - only 1.9 per cent in the structure of total industry export.

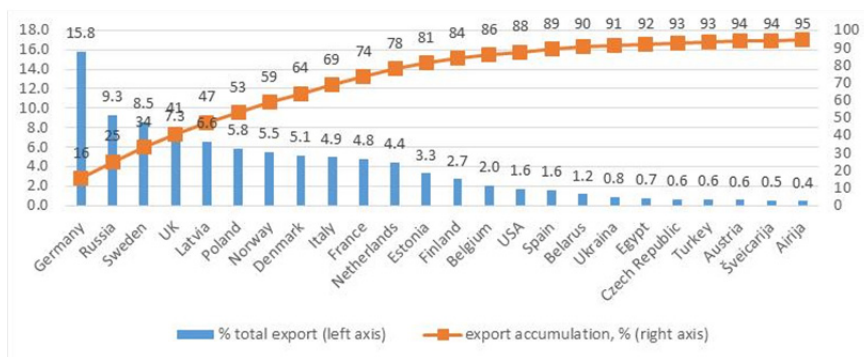
Since traditional technology industry makes the biggest share of value added and export in Lithuanian manufacturing industry, due to its significantly high volumes in total manufacturing industry's structure even the smallest export changes in this industry can have a significant impact on total economics of the country. On the other hand, strategic priorities of Lithuanian economic development declared by the Government of the Republic of Lithuania anticipate that Lithuania should transfer from traditional technology industries to highly innovative technologies during the long term. That is why export changes in all sectors that are able to manufacture with higher than average value added are extremely important to economics of the country.

One of the ways to decrease the adverse effects on export is export diversification by markets and products. In further section, we are analysing export diversification levels in the sectors with different technologies and comparing them.

3.2 Lithuanian manufacturing industry's export structure by countries

The structure of low-technologies export by countries has been presented in Figure 2. The biggest share has been taken by the export to Germany (16 per cent), Russia (9 per cent) and Sweden (9 per cent). The export of Lithuanian traditional technology industry production to other countries is lower, but it shows the obvious orientation the EU countries.

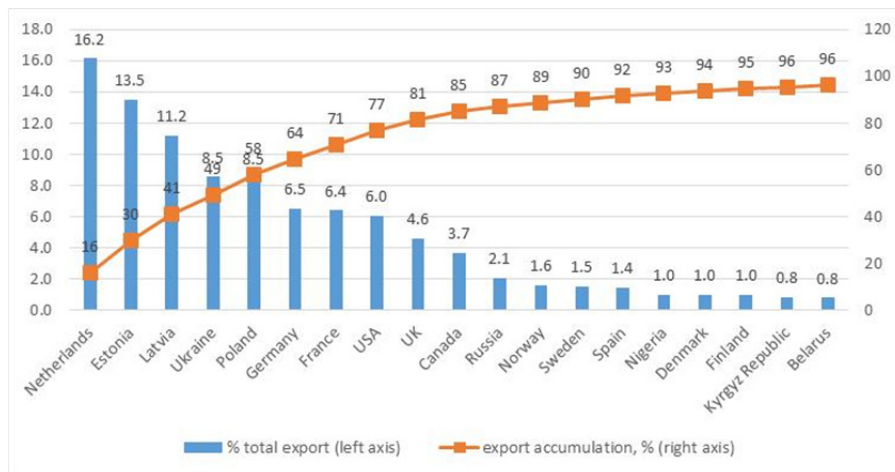
Figure 2. Low-technology industry export structure by countries in 2011



Source: Authors' analysis.

Different distribution of the countries can be observed in the structure of medium-low-technology industry export (Fig. 3). Here, the biggest share of production is exported to the Netherlands (16 per cent), Estonia (13 per cent) and Latvia (11 per cent). Although the biggest share of the production is exported to the EU countries, the export to Ukraine (9 per cent), USA (6 per cent), Canada (4 per cent), Russia (2 per cent), Norway (2 per cent) is also significant.

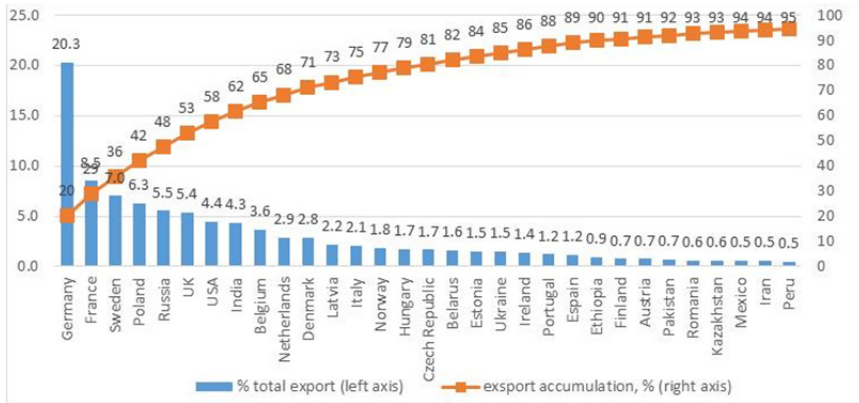
Figure 3. Medium-low-technology industry export structure by countries in 2011



Source: Authors' analysis.

Analysing the diversification of medium-high-technology industry export by countries, it can be seen that export to Germany again takes the highest positions – in 2011, its share in total export made 20 per cent (Figure 4). Other significant export markets are France (8 per cent), Sweden (7 per cent), Poland and Russia (6 and 6 per cent). In the export of this industry production, the EU countries are also prevailing.

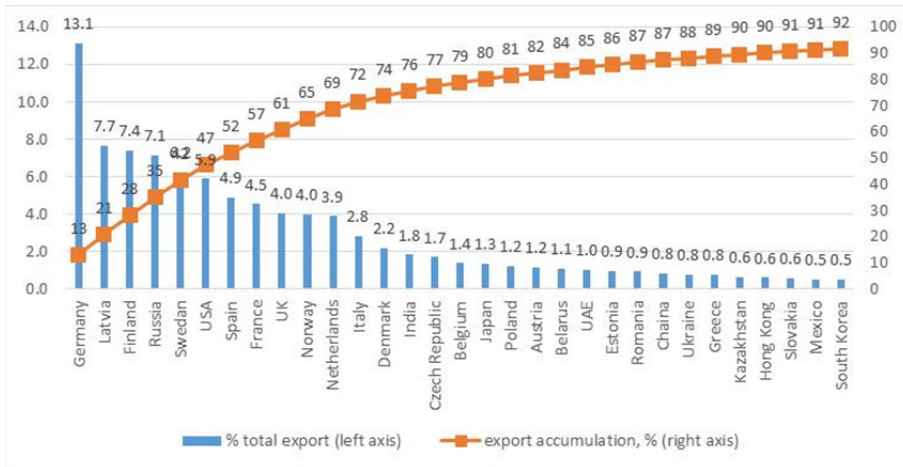
Figure 4. Medium-high-technology industry export structure by countries in 2011



Source: Authors' analysis.

Very similar distribution of the countries can be observed in the structure of high-technology industry export (Figure 5). Here, the biggest share of production is exported to Germany (13 per cent) and the EU countries. Export to Latvia (8 per cent), Finland, Russia (7 and 7 per cent), Sweden and USA (6 and 6 per cent) is also significant. On the other hand, high-technology industry exports its production to more different countries in comparison to total Lithuanian export. The production of high-technology industry is exported to such global markets as China, United Arab Emirates, Hong Kong, Mexico, South Korea and others, but in small quantities.

Figure 5. High-technology industry export structure by countries in 2011



Source: Authors' analysis.

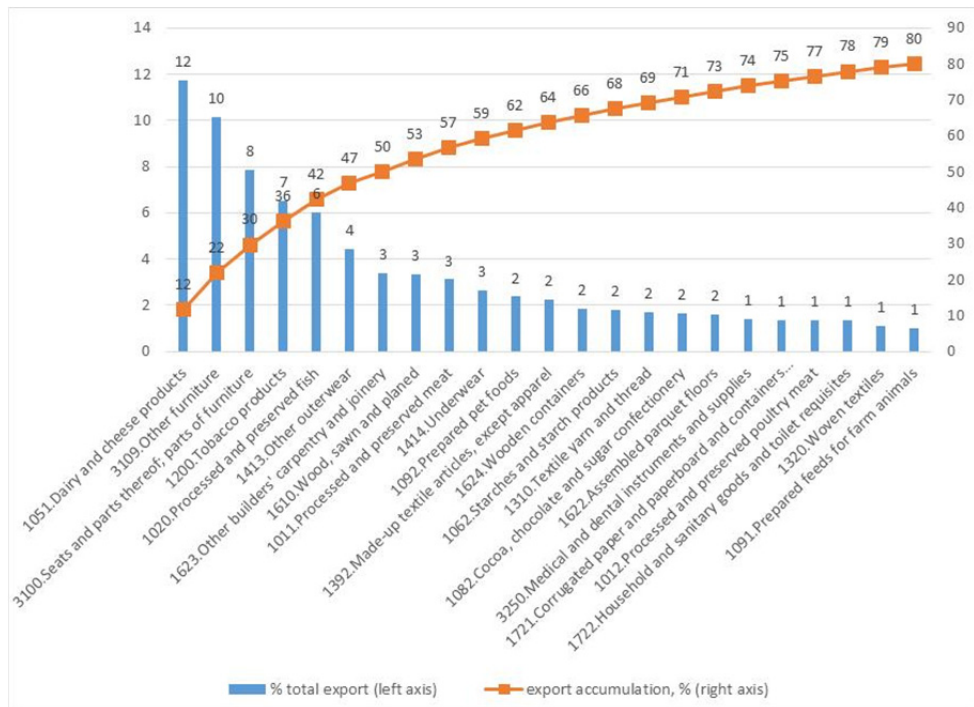
The analysis of export distribution by countries in different industry sectors with different technological level revealed that all Lithuanian manufacturing industry's export is obviously orientated to geographically close countries – the EU countries and Russia. Export concentration to Russia and the countries economically related to it such as Latvia, Estonia, Byelorussia, Ukraine is strong enough, and this poses a threat for the development of Lithuanian export. The threat is associated not only with quite changeable Russian internal demand but also with possible political decisions which, as it

is considered, have influenced the recent events in Lithuanian foreign trade. Prohibition to import Lithuanian dairy products to Russia and strengthened Lithuanian truck control have caused a lot of damage to Lithuanian exporters. Export to the EU countries provides greater stability, but it must be considered that even here markets are strongly interrelated, so demand fluctuations in any country, especially in such big one as Germany, can have the impact on internal demand of other countries. Thus, immunization of Lithuanian export by diversifying export markets as well as stronger orientation to global markets – Asia, Africa, North and South America – are necessary (by the opportunity).

3.3 Lithuanian manufacturing industry's export structure by products

Analysing export structure by products, 4-digit group level CPA classification was used. Figure 6 presents the structure of Lithuania's low-technology industry export by products. As it can be seen from the figure, export by products in this sector is rather differentiated, but some product groups are predominant. The biggest share of the export is made of dairy and cheese products (12 per cent), other furniture (10 per cent), seats and parts thereof; parts of furniture (8 per cent), tobacco products (7 per cent), processed and preserved fish (6 per cent), other outerwear (4 per cent) and other builders' carpentry and joinery (3 per cent). In 2011, all these products made 50 per cent of total low-technology industry export.

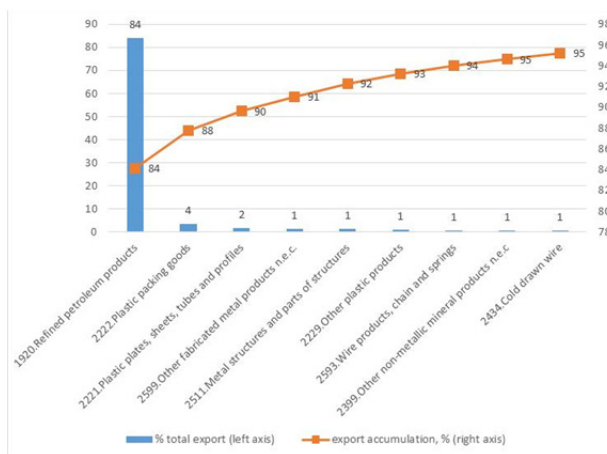
Figure 6. Low-technology industry export structure by products in 2011



Source: Authors' analysis.

Considering the structure of medium-low-technology industry export by products (Figure 7), it can be seen that the export of this industry is highly concentrated in a single product group - refined petroleum products - which makes as much as 84 per cent of total export of the sector.

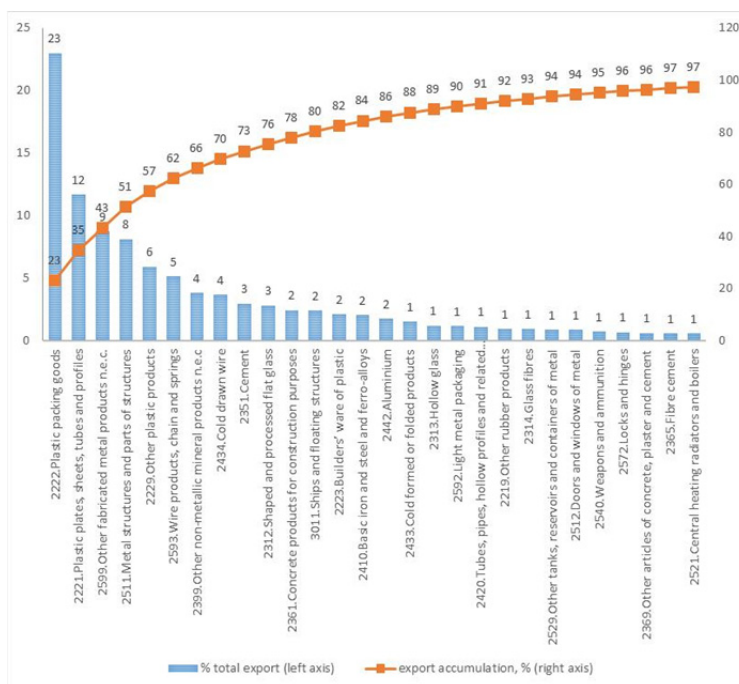
Figure 7. Medium-low-technology industry export (including refined petroleum products) structure by products in 2011



Source: Authors' analysis.

As it can be seen from Figure 7, the export of the other products in this industry makes insignificant part in comparison to refined petroleum products. That is why it is purposeful to analyse this sector in more detail excluding refined petroleum products. The structure of medium-low-technology industry export by products excluding refined petroleum products has been presented in Figure 8. In this case, a much greater degree of product differentiation can be observed, although only four product groups make more than 50 per cent of total export of this industry.

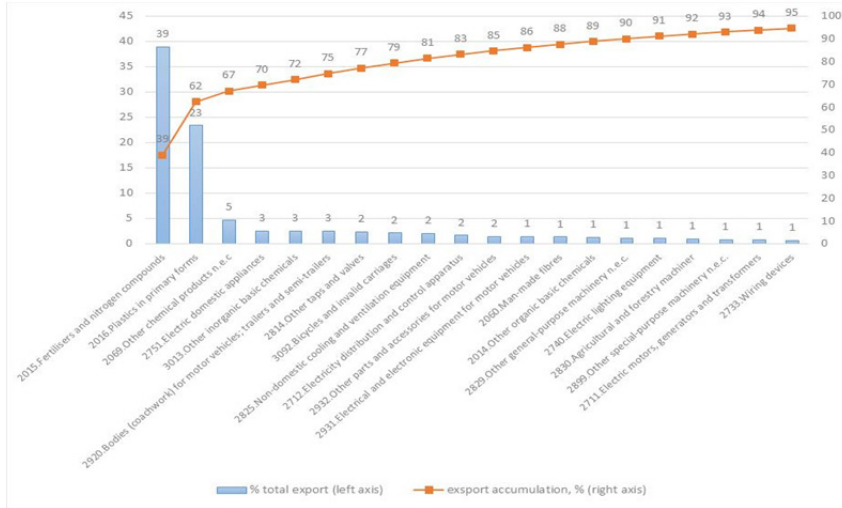
Figure 8. Medium-low-technology industry export (excluding refined petroleum products) structure by products in 2011



Source: Authors' analysis.

Figure 9 presents the structure of Lithuanian medium-high-technology industry export by products. As it can be seen from the figure, export in this sector is concentrated in two main product groups while other products compose a small part of the export. In 2011, fertilisers and nitrogen compounds and plastics in primary forms together made 62 per cent of total export of the sector which means that medium-high technology export is not highly differentiated by products.

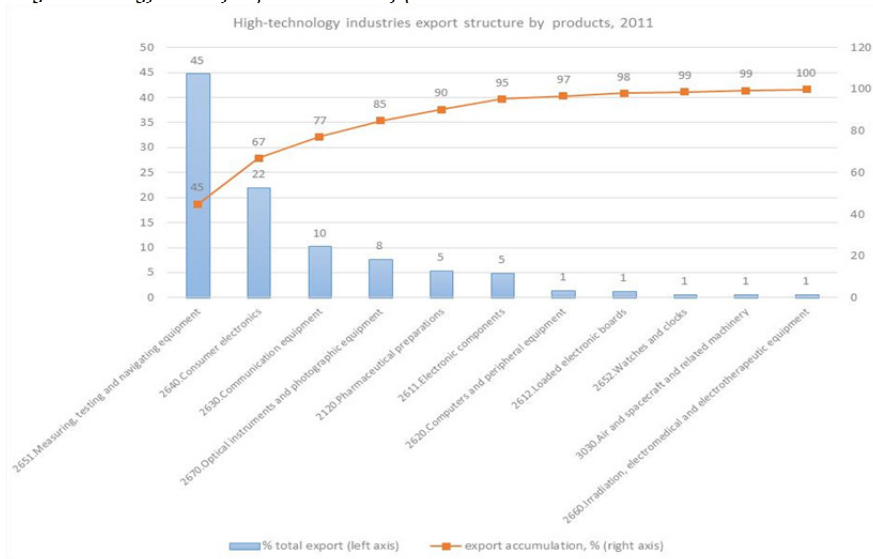
Figure 9. Medium-high-technology industry export structure by products in 2011



Source: Authors' analysis.

Considering the structure of high-technology industry export, which has been presented in Figure 10, it should be noted that export of this sector does not show high product differentiation either. Only a single product group - measuring, testing and navigating equipment – made 45 per cent of total export of the sector. This sector is not big – it consists only of some product groups, but their export volumes have been distributed unevenly.

Figure 10. High-technology industry export structure by products in 2011



Source: Authors' analysis.

All the figures explicated above reveal that Lithuanian manufacturing industry's export does not show high differentiation, considering both equal export distribution among countries and the production exported. Slightly higher diversification can be observed in low-technology-industry export. However, more precise level of export diversification can be established by invoking concentration indexes.

3.4 Evaluation of Lithuanian manufacturing industry's export concentration

For more precise evaluation of Lithuanian manufacturing industry's export concentration, Herfindahl – Hirschman indexes were calculated. These indexes were calculated for each industry with different technological level. Export concentration was evaluated by countries and products. For medium-low-technology industry, evaluating export concentration by products, HHI was calculated twice: including petroleum products and excluding them. The values of the indexes have been presented in Table 2.

Table 2. HHI values of Lithuanian manufacturing industry's export

Industry	HHI by countries		HHI by products	
	value	assessment	value	assessment
Low-technology	0.198	moderately concentrated export	0.124	unconcentrated export
Medium-low-technology				
• including refined petroleum products	0.224	moderately concentrated export	0.819	highly concentrated export
• excluding refined petroleum products	0.199	moderately concentrated export	0.200	moderately concentrated export
Medium-high-technology	0.203	moderately concentrated export	0.378	highly concentrated export
High-technology	0.161	moderately concentrated export	0.337	highly concentrated export

Source: Authors' analysis.

As it can be seen from Table 2, export concentration by countries in all manufacturing industry sectors is moderate. It shows that demand shock, linked with the main countries – trade partners, could have a significant impact on industrial export. Considering export concentration by products, the only low-technology industry export is well-diversified and can be treated as unconcentrated export. Medium-low-technology industry export by products could also be treated as moderately concentrated if it was evaluated excluding refined petroleum products. Medium-low-technology including refined petroleum products; medium-high-technology and high-technology industry exports are not well-diversified and can therefore be treated as highly concentrated exports. It proposes that Lithuanian manufacturing industry's export should be better diversified by both countries and products.

4. Conclusions

The article is aimed at the identification which Lithuania's manufacturing industry sectors are more capable to withstand different demand and supply shocks raising due to the global trade. Our research revealed that despite strategic orientation of Lithuanian economic development to medium-high technology sector, low-technology production makes the biggest part of value added and export in Lithuanian manufacturing industry. That is why due to the big share in total structure of manufacturing industry; even smallest changes in this industry's export can have a significant impact on the total economics of the country.

Further research revealed that all Lithuanian manufacturing industries, seeking to avoid bigger impact of other countries' demand fluctuations, insufficiently diversify their exported production by countries and their export can be treated as moderately concentrated. What is more, all Lithuanian manufacturing industry's export is orientated to geographically close countries – the EU states and Russia. Strong export concentration to Russia and the countries which are closely economically linked with it such as Latvia, Estonia, Byelorussia and Ukraine poses a threat on the development of Lithuanian export due to rather changeable internal demand and possible political decisions that can influence Lithuanian economics. Export to the EU states provides higher stability, but it should be noted that markets here are also closely interrelated, so demand fluctuations in any country can have the impact on internal demand of other countries. That is why seeking for higher diversification of Lithuanian export, orientation to other global markets such as Asia, Africa, North and South America is necessary.

The research of Lithuanian export diversification by products revealed that only low-technology or co-called

traditional technology industry export is well-diversified by exported production. The export of other industries is highly concentrated in this respect. It means that traditional technology industry export, which is extremely important to the economics of the country, is best-prepared from all sectors to withstand unfavourable external effects. Considering the fact that traditional technology industries are not homogenous (although they are sometimes considered to be so) and their sub-sectors create the products of different value added (also very high), it can be stated that this industry can be competitive in the long term. Therefore, it should earn not only scientific interest for the research but also should be considered by politicians making long-term strategies and forming maintenance and promotion policies.

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